

THE FIRST CENTURY OF METEOROLOGICAL DATA IN AMERICA

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Adequate information regarding the provenience of early meteorological data compiled in this country, is not easily available to present-day climatologists. Contemporary references to the early tabulations, and citations to bibliographic sources are, at best, fragmentary. Students of climatic cycles and long-time trends have been concerned mainly and necessarily with a few exceptional series extending through many consecutive years prior to the compilation of official observations.¹ In studies of the history of climatology interest has been mainly centered upon the relative times of beginning of records at certain stations together with the lengths of the periods during which individuals continued their observations.²

Obscured by this emphasis upon a few remarkable or especially useful records are numerous other tabulations, usually sporadic and shortlived, contemporary with them. Since the third century of activity in systematically recording weather data in this country is now opening, a memorialistic inventory seems appropriate.

This inventory includes only temperature and rainfall records, obtained instrumentally and with evident care, for at least 1 year, during the century from 1738 to 1838. In the interests of economy of space and simplicity, the principal information is presented graphically, to show the observation stations and the length of the record made at each; the inclusion of a station on this graph indicates that the data are available in the literature, though sometimes only in manuscript, and that they are believed to be accurate insofar as limited records can be. In the majority of cases observations of other weather phenomena were also made at the same places. Many known temperature and rainfall series, nearly 50 in number, have been deliberately omitted because they are of doubtful accuracy and validity or because the observations were frequently interrupted. Many other series perhaps entitled to inclusion in a select list of statistical resources contributed during the first centennium, may have been unknowingly excluded because the data have resisted discovery during a reasonably exhaustive search. Omissions of manuscript records are especially likely, since many may be on file in lesser known institutions or in the homes of descendants of the men who devoted themselves, without compensation, to this work.

One or more of the following four procedures have been followed in selecting the temperature and rainfall series for inclusion in this presentation:

(1) *Inspection of the manuscript record.*—The original manuscript record, if it can be found, is almost certain to contain internal evidence of its authenticity and of the integrity of the observer. Usually containing more detail than the published version (if, indeed, the data were ever published), the very appearance of the journal is a clue to the workmanship of the individual. A carefully made record may be presumed to imply equal care in the exposure and reading of the instruments even if precise information as to these circumstances is lacking. Usually, however, the original manuscript states exactly the names

of the manufacturers of the instruments and gives details as to their exposure. For example, one learns from the first page of the 37-volume meteorological diary of Dr. E. A. Holyoke, that his long-time temperature series at Salem, Mass., was read from "accurate instruments made . . . in London and . . . suspended in the open air in the shade on the north side of my house in the main street of Salem about 7 feet above the ground,"³ valuable information omitted from the published data. In the Holyoke journal, as in the majority of early manuscripts still available, temperature data are given in tenths of a degree, strongly suggestive of precision in the reading of the instrument. Since there were no journals devoted to the printing of climatological material during this period, some of the data referred to in this inventory exist only in manuscript form, the most important collections being in the Essex Institute of Salem, the Harvard College Library, the American Academy of Arts and Sciences in Boston and the American Philosophical Society. The latter two institutions, during the half-century following the Revolution, took a special interest in the diffusion of climatological knowledge and devoted many pages of their *Transactions*, *Proceedings* and *Memoirs* to the reproduction of monthly and annual summaries compiled at many eastern points.

(2) *Comparison of the data with modern records.*—An estimate of the accuracy of early records may be formed by comparing them with the means derived from series of known reliability, due allowances being made, of course, for annual or short-period departures from averages. The greatest discrepancies between early and modern records usually occur in the rainfall data, perhaps owing mainly to the difficulty of measuring snowfall. For example, James Barrell, who kept a 10-year rainfall record at Charlestown, Mass. (1792–1802), states that his gage was "60 feet above the level of high water," but complains "I have no way [accurately?] to measure the snow." Nevertheless, Barrell seems to have done remarkably well, for his 10-year average of 39.9 inches agrees with modern computations.⁴ It will be noticed from the graph that temperature was recorded more generally than rainfall, presumably because thermometers can be exposed and read with greater ease than rain gages. Discrepancies also arise from the different hours at which observations were made. The lowest temperatures often escaped record in the days prior to the common use of the maximum and minimum thermometer, thus causing daily means to be slightly higher than in modern records. Favored hours of observation were 8 a. m., 1 p. m., and sunset, or such as would not seriously interfere with the individual's principal occupation. The majority of the observers from 1738 to 1838 were, as might be surmised, physicians, clergymen, farmers, and professors.

(3) *The judgment of early climatological writers.*—A further check on the authenticity of some climatic data is provided by the evaluation given them by early writers, among whom was C. F. Volney, who, in the preparation of his geographical work published in 1803,⁵ made a reasonably objective study of the climatic data then available and used those series that seemed to be most reliable. A much more valuable critique of the early data is to be found in

¹ For example: J. B. Kincer, "Is our Climate Changing? A study of long-time temperature trends," *Mo. Wea. Rev.*, 61: 261–259, 1933.

² For example: B. B. Whittier, "An Old Weather Diary in Northeastern Indiana," *Mo. Wea. Rev.*, 63: 224, 1935; J. R. Weeks, "Baltimore Weather Records for Over 100 Years," *Ibid.*, 61: 260, 1933; George S. Bliss, "Dr. Jesse C. Green, 1817–1920," *Ibid.*, 48: 413, 1921; J. Warren Smith, "Long Individual Meteorological Records," *Ibid.*, 48: 533, 1921.

³ "A table of results, 1786–1791," *Ms. Essex Institute*.

⁴ *Memoirs Amer. Acad. of Arts and Sciences*, 3: 104, 1809–10.

⁵ *Tableau du Climat et du Sol des États Unis d'Amérique*, Courcier et Dentu, Paris.

Blodget's *Climatology*.⁶ In the first chapter of this notable volume, Blodget offers a 50-page summary of "the statistics of meteorological observation" and lists nearly all the data that are of significance up to the year 1855. These tables, containing brief citations to the literature, provide a valuable reference book for the climatologist who is at all concerned with the earlier materials.

(4) *The judgment of modern climatologists*.—Modern climatologists who have had occasion to use the earlier data have found, almost without exception, that they are comparable in accuracy with those of the more recent past. Thus, Goodenough saw "no reason whatever to doubt the accuracy of Professor Winthrop's record," made at Cambridge prior to the Revolution.⁷ Kincer, in discussing the early tabulations for New Haven and Washington, offers assurance that "the fundamental observational data are trustworthy and are of such character as to afford complete confidence in their integrity."⁸ In similar vein, Milham found a "good agreement" among the data of five early New England stations (Williamstown, New Haven, Salem, New Bedford, and Cambridge) and adds that "observations of some value were probably made during 1816 (a notoriously cold year) at Castine, Sharon, Deerfield, and Philadelphia."⁹

The year 1838 marks the end of the first century of instrumental recording of weather data in this country; but climatologically it has no more significance than any other year at about that time. If one were seeking epoch-making dates in this field, 1819 might logically be chosen. In that year instrumental observations were first made by the military at Fort Snelling, Minn., initiating, so to speak, the official type of record; until 1819, all the statistical material had been compiled by self-appointed observers who performed their exacting and somewhat tedious duties simply because they wanted to. Other Army posts soon followed the example of Fort Snelling; and by 1838, daily records were being made at 13 forts, mainly in the Midwest. Another advance toward an official system of weather records was effected by the system of stations organized about 1835 by the New York Board of Regents; this body encouraged the collection of data by professors

and principals at the various academies and colleges in the State, a program that explains the existence of numerous New York stations during the early days. A similar system in Pennsylvania, approved in 1839, appears to have died aborning.

The value of simultaneous observations with standardized apparatus and hours of observation at many places had been recognized before 1819, however. Thomas Jefferson, in a letter to Volney in 1797 tells of his plan for supplying "some persons in every [Virginia] county" with instruments necessary for accurate observations of weather, and his hope that in due time this practice would extend to the several States, adding that "this long-winded project was prevented by the war which came upon us and since that I have been far otherwise engaged."¹⁰ Similarly, Dr. B. S. Barton, of the University of Pennsylvania suggested in 1807 that thermometers, barometers, and rain-gages be operated by the Linnean Society of Philadelphia and that similar observations be made by the members of the society in different parts of the Union so that at some future time "a complete history of our climate might be constructed."¹¹

Many may wonder as to the incentives which led so many men to undergo the daily drudgeries of instrument reading without the prospect of monetary compensation. Perhaps the reasons advanced by two such men themselves may serve as examples: Noah Webster, bothered by various conflicting theories as to the origin of dew, and seeking relaxation from his regular occupation, performed a "series of experiments" in order, simply, to ascertain the truth.¹² James Winthrop states that he carried out his observations near Cambridge from 1797 to 1803 that "I might obtain a general knowledge of our climate and its variations."¹³ At a later time, such men would doubtless have become productive members of the climatological fraternity. Unfortunately, we shall never be able to construct, as Barton hoped, "a complete history of our climate," but the records referred to in this inventory, emanating largely from the desire of men to learn the truth, enable us to treat the matter to some extent, even though fragmentarily.

⁶ Lorin Blodget, *Climatology of the United States*, Philadelphia and London, 1857. For an appreciation of this volume see R. deC. Ward in *Mo. WEA. REV.*, 42: 23-27, 1914.

⁷ "Rainfall in New England," *Journ. New Eng. Water Works Ass'n.*, 29: 239, 1916.

⁸ *Mo. WEA. REV.* 61: 255, 1933.

⁹ Willis I. Milham, "The year 1816—the causes of abnormalities," *Mo. WEA. REV.*, 52: 563-570, 1924.

¹⁰ Letter to Volney, Jan. 8, 1797, in *Volney et l'Amérique*, The Johns Hopkins Univ. Press, p. 62, 1923.

¹¹ "Discourse on natural history," *Journ. Phila. Medical Soc.*, 1807, p. 61.

¹² Results published in *Memoirs Amer. Acad. of Arts and Sciences*, 3. Part I, 95-103, 1809-19.

¹³ *Mass. Soc. for the Promotion of Agriculture*, 1804, p. 20.



